

SANYA PETROVIC, M.Sc.

EDUCATION Master of Science (Institute of Medical Science), University of Toronto,
Toronto, Ontario, 2000

Bachelor of Science (Honours Biology), University of Waterloo,
Waterloo, Ontario, 1990.

CAREER SUMMARY

1999-present **Jacques Whitford Environment Limited**, Burnaby, BC
Group Manager, Risk Assessment
Associate Corporate Director - Environmental Risk Assessment

1994 - 1997 **Golder Associates Ltd.**, Burnaby, BC
Toxicologist

1990 - 1994 **CanTox Inc.**, Mississauga, ON
Toxicologist I / Toxicologist II

RELEVANT EXPERIENCE

Senior toxicologist responsible for environmental risk assessment activities and management of multi-disciplinary environmental projects. Practice areas include air quality assessments, specifically focussing on air toxics issues as well as contaminated sites assessment and property redevelopment. Responsible for risk communication and WHMIS training. Provides senior technical review of human and ecological risk assessments.

AIR QUALITY

- Prepared a detailed toxicological summary regarding potential human health effects of ambient particulate matter. The project involved a thorough review of recent epidemiological and toxicological data for ambient particulate matter, specifically PM_{2.5}, PM₁₀ and total suspended particulates (TSP).
- Responsible for assessment of health effects of residents exposed to mold in homes in a large-scale remediation project. Activities include ongoing risk communication of health effects to the public.
- Risk communication of health effects associated with exposure to the mold *Stachybotrys chartarum* to workers in a public building. Responsibilities include ongoing communication with management and staff members throughout the investigation and remediation of the site.
- Reviewed toxicological data pertaining to air toxics released from incineration and provided a ranking of inhalation toxicity of chemicals to humans. These data were used to assess potential risks of exposure of human receptors in the area of impact.
- Project manager for assessment of VOC emissions from waste oil boilers, natural gas boilers and paint booth emissions. Responsible for development of sampling protocol and coordination of sampling services.
- Conducted a risk assessment for humans exposed to vinyl chloride in ambient air resulting from subsurface contamination in BC. Volatilization of vinyl chloride in groundwater and soil was assessed using a soil gas transport model to estimate potential exposure of human receptors on-site. The assessment was conducted for a commercial scenario in BC. A toxicological assessment was undertaken to compare exposure to acceptable concentrations in indoor and outdoor air. Information from the exposure and toxicity assessments was used during consideration of risk management options at the sites in question due to the difficulty in extracting the contamination.
- Modeled air concentrations of BTEX at a gasoline station where subsurface soils were contaminated from a leaking tank in Quebec. Potential exposure to BTEX was determined in both indoor and outdoor air for the commercial receptor on-site.
- Conducted a human health quantitative risk assessment for contaminants in landfill gas, bottom ash and flyash for a landfill in Coquitlam. The problem formulation was conducted

for human and ecological receptors on-site following site reconnaissance. Ecological receptors in the area were identified through literature review and agency contacts. Exposure assessment involved modelling of landfill gas to receptors indoors and outdoors on-site, as well as modelling potential inhalation of particulates in bottom ash used as a surface covering material. Toxicity assessments were performed on contaminants in groundwater, soil/bottom ash and landfill gas. The risk assessment was conducted for redevelopment of the landfill as a driving range for golfers.

- Conducted a risk assessment to identify potential human health effects resulting from contamination of groundwater at a site adjacent to a gasoline station in Alberta. Groundwater concentrations identified in the environmental site investigations were used to estimate indoor air concentrations and potential risk to future receptors on-site using a soil gas infiltration model. In addition, chemical concentrations entering a nearby river were estimated using a groundwater transport model to identify potential exposure to aquatic receptors.
- A screening risk assessment was conducted for soils at a residential site that had been historically used as an oil transfer station in Alberta. Estimates of exposure to chemicals in soil via ingestion, dermal contact, inhalation of volatiles and fugitive dust were used to estimate potential risk to humans at the site. Risk-based reference concentrations were used to guide risk management decisions at the site.
- Conducted a human health screening risk assessment regarding exposure to electric arc furnace (EAF) dust, including identification of receptors and critical routes of exposure as well as a toxicity assessment of various metals determined to be of potential concern. The assessment was conducted for off-site receptors in Ontario, and involved modeling of fugitive dust in air. Chemical concentrations in soils were used to estimate particulate-bound concentrations of chemicals in air.
- Evaluated potential health risks of metals associated with mine tailings for the purpose of a human health risk assessment. Chemicals of concern at the site included arsenic in soils. The exposure assessment included modelling of fugitive dust emissions in air for potential exposure of workers and residents downwind of the site.

RISK ASSESSMENT

- Lead risk assessor for the human health risk assessment (HHRA) and ecological risk assessment (ERA) component on a Community Based Risk Assessment (CBRA) in Port

Colborne, Ontario. The scope of work for the CBRA was prepared to identify potential risks associated with residual chemicals in soils in an area of 29km² resulting from historical air emissions from a nickel refinery. Responsibilities include risk communication with the Technical Steering Committee and the Public throughout the risk assessment process.

- Member of an Expert Panel for the Canadian Coast Guard guiding the development of cost-effective strategies to assess potential human and environmental risks associated with contamination at various lightstation properties in coastal British Columbia. The goal of the panel is to obtain consensus among the risk assessment experts for a defensible and cost-effective method to deal with contamination at numerous lightstation properties that is protective of human health and the environment.
- Prepared a Technical Assistance Bulletin (TAB) regarding risk assessment of contaminated sites for Environment Canada. The bulletin describes risk assessment context, applications and framework in language that is easily digested for a wider audience.
- Project manager for a supplemental site investigation (SSI) and detailed qualitative risk assessment (DQRA) for a commercial/industrial site in Richmond, BC owned by DND. Contaminants at the site included dioxin/furan, PCB, PAH and metals. Groundwater, surface water, sediment and soils were analyzed at the site for contaminants of concern. The DQRA was conducted for both human and ecological receptors at the site.
- Participated in preparation of a position paper regarding the feasibility of combined or cumulative risk assessment of radiological and non-radiological hazards for humans and the environment in the vicinity of the Maine Yankee nuclear power plant in the United States.
- Assessed potential exposure and risks to human and aquatic receptors from weathered subsurface Bunker C oil in BC. A literature review of aquatic species in Burrard Inlet was conducted for the assessment. A narcotic approach was used in evaluation of aquatic toxicity to petroleum hydrocarbons, using surrogates for heavy extractable petroleum hydrocarbons.
- Project manager for human and ecological quantitative risk assessments (QRA) for several sites in Esquimalt, BC. Supervised monitoring required for the supplemental site investigation. Potential exposure and risks associated with exposure to metals in soils were evaluated for both human and ecological receptors. Consideration was given to both on-site receptors and off-site receptors due to the potential for migration of chemicals in groundwater.

- Project manager for a field survey (FS) and preliminary qualitative risk assessment (PQRA) for a gun range located in Coquitlam, BC. Metals from gun range activity, such as lead and antimony, were monitored in surface soils, surficial water and groundwater were of interest for potential human and ecological receptors located on-site and off-site.
- Performed a problem formulation to identify potential exposure of human and ecological (terrestrial and aquatic) receptors to Bunker C oil, diesel, and kerosene contamination in BC.
- Evaluated potential adverse effects from lifetime consumption of shellfish contaminated with polynuclear aromatic hydrocarbons (PAH), with focus on benzo(a)pyrene in Kitimat, BC for a human health risk assessment. Project involved determination of background exposure to benzo(a)pyrene in a rural environment for comparative purposes to indicate the conservative nature of the risk assessment.
- A risk assessment was conducted to estimate exposure of human and ecological receptors at an experimental proving ground at a military site used for storage and disposal of chemical warfare agents in Alberta. Chemical concentrations in soils were determined in an environmental site assessment. Estimates of potential risk to ecological receptors were used to determine risk-based reference concentrations to guide risk management decisions at the site.
- For an ecological assessment, the presence of terrestrial and aquatic receptors in a green zone of a former industrial area was evaluated based on literature review to determine potential risk to burrowing mammals from subsurface hydrocarbons and to aquatic receptors following groundwater transport of hydrocarbons and metals in BC.
- Performed human health screening risk assessments at several sites in the Vancouver area to identify potential human health impacts of hydrocarbons in soil to commercial and residential receptors on-site.
- Quantitatively assessed human exposure to pentachlorophenol-contaminated soil at a site assuming ingestion, inhalation and dermal exposure in BC. Potential inhalation exposure was determined using a model which calculates exposure following erosion of soil particulates and a simple mixing box model in air. Risks based on current and future exposure were estimated for commercial workers on-site.
- Assessed the potential for adverse human health effects of metals in surface soil and hydrocarbons in subsurface soil at a site that was formerly used as a shipyard in Esquimalt,

BC. The project also involved sampling of groundwater near the shoreline to identify the potential for exposure of aquatic receptors to organic and inorganic contaminants from the site, to determine the requirement for further ecological assessment.

- Conducted a supplementary environmental investigation at a former furnace oil depot in BC. Scope of work included drilling, installation of monitoring wells, excavation of test pits, soil and groundwater sampling and groundwater characterization, vapour sampling. A human health risk assessment was subsequently conducted to assess risks associated with leaving contamination in-place. The risk assessment and a conceptual remedial plan was developed and submitted to BC Environment for review.
- Conducted an ecological screening risk assessment for cadmium and zinc contamination in a drained industrial effluent pond located at the edge of a marshy environment in Italy. Potential receptors considered for the area were terrestrial plants and invertebrates expected in the topsoil following development, as well as aquatic receptors 300 m from the site. Groundwater modelling was conducted to determine metal transport to the aquatic receptors. Literature was reviewed for determination of potential toxicity to receptors of concern. The screening risk assessment was submitted to Italian regulators for review.
- Problem formulation for identification of potential adverse human health effects associated with exposure to a site contaminated with leaking heating oil. Problem formulation involved identification of potential receptors and potential routes of exposure.
- Conducted a screening risk assessment for two contaminated properties proposed for combined commercial/residential use. The contamination on site was mainly metals related to historical landfilling and smelter operation. The risk-based approach was used to guide risk management decisions at the site.
- Conducted a supplementary field investigation and screening level risk assessment of a historical site. The proposed development was in an area contaminated with petroleum hydrocarbons. Preliminary investigation revealed that a large portion of the site was contaminated with petroleum hydrocarbons above industrial land-use criteria, with localized areas above Special Waste Regulation levels, including NAPL. Risk-based reference concentrations were developed for human, terrestrial and aquatic wildlife.
- Participated in a review to assess the effects of coastal metal mine effluent on the marine environment through the use of a case study in BC. The mine selected for study used the submarine tailings discharge method of disposal into a deep-water fjord and had a monitoring

program for over 20 years. The environmental impacts of this disposal method have been the subject of great debate in recent years since this method is one worthy of consideration from an environmental and fiscal perspective.

- A screening risk assessment was undertaken to determine the potential risk associated with DDT in soils at an isolated non-residential site in northern B.C. DDT was present from historical contamination. Potential receptors included people who used the site for hunting and camping periodically through the year. Risks associated with incidental ingestion, dermal contact and fugitive dust inhalation were estimated for this site.
- Participated in a risk assessment survey designed to evaluate the application of risk assessment for redevelopment of contaminated sites for residential land use. Completed a hypothetical case study designed to re-create a real world problem of exposure scenario analysis, exposure assessment, toxicity assessment and risk estimation.

TOXICOLOGY

- Review of toxicological literature to determine acceptable daily exposures to a variety of chemicals resulting from incineration, including metals and PAHs. Additional literature was reviewed to identify background exposure to these chemicals from air, water, soil and food.
- Literature review of non-clinical laboratory and epidemiological studies of electromagnetic radiation to determine the potential for specific adverse health effects in humans.
- Evaluated literature pertaining to environmental biotechnology, including bacterial remediation and use of algae in waste treatment, oil recovery, bioleaching and biosensors.
- Reviewed literature on chemicals used in the manufacture of rubber to determine the potential for adverse effects on human health from exposure to various chemicals at specific levels in an occupational setting.
- Preparation of toxicology data screens (TDS) and review of reports for a pesticide submission in order to facilitate governmental review of the submission.
- Identification of Canadian pesticide regulations regarding acceptable concentrations of pesticides on tobacco products grown in or imported into Canada.

- Prepared concise reports of recent toxicological literature to identify the potential endocrine disrupting effects of the pesticides endosulfan and lindane, which have been suggested to behave as xenoestrogens. Identified the potential exposure and/or tissue residues of humans and ecological receptors. The reports were peer-reviewed.
- Toxicological literature review of MMT (methylcyclopentadienylmanganesetricarbonyl) to identify potential adverse human health effects associated with use of MMT as an additive in unleaded gasoline.
- Quantitative and qualitative toxicity assessments of a wide variety of flavours, evaluating potential for adverse human health effects from consumption in various products. Projects involved identifying Canadian and U.S. regulations for specific flavours and evaluating background exposure from naturally occurring compounds as well as food additive use.
- Reviewed and interpreted monographs relating to flavour agents for inclusion in a database which will be the basis for a conceptual paper on the safety evaluation of flavours.
- Literature review of gastrointestinal microflora in humans and laboratory animals to identify normal background microbial populations and alterations in bacterial populations following dietary change. This project also involved identifying methods of analyzing these parameters to determine the most cost-efficient and scientifically defensible protocol acceptable to governmental agencies.
- Identified compounds with the potential to cause adverse dermal effects and sensitization in an occupational setting through a review of material safety data sheets (MSDS) of pigments used to coat plastics. Identified exposure of affected workers to various compounds to determine the sensitizing agents.

PUBLICATIONS AND PRESENTATIONS

Urch, B., Petrovic, S., Speck, M., Brook, J., Liu, L., Tarlo, S., Lukic, Z., Corey, P., Zimmerman, B. and Silverman, F. 2001. Controlled Exposures to Concentrated PM_{2.5} with Added Ozone or Sulphur Dioxide: Respiratory/Inflammatory Measures in Asthmatics and Non-asthmatics. *Am J Resp Crit Care Med* 163(5):A265.

Petrovic, S., Urch, B., Brook, J., Datema, J., Purdham, J., Liu, L., Lukic, Z., Zimmerman, B., Tofler, G., Downar, E., Corey, P., Tarlo, S., Broder, I., Dales, R. and Silverman, F. 2000. Cardiorespiratory Effects of Concentrated Ambient PM_{2.5}: A Pilot Study Using Controlled Human Exposures. *Inhalation Toxicology* 12(Suppl 1):173-88.

Petrovic, S., Urch, B., Liu, L., Brook, J., Purdham, J., Tarlo, S., Downar, E., Corey, P., Zimmerman, B. and Silverman, F. 2000. Cardiorespiratory Effects Following Inhalation of Concentrated PM_{2.5} With and Without Ozone in Mild Asthmatics. *Am J Resp Crit Care Med* 161 (3):A239.

Urch, B., Silverman, F., Petrovic, S., Lukic, Z., Purdham, J., Corey, P. and Shephard, R.J. 2000. Carbon Monoxide (CO) Exposure in Runners: A Comparison of Fixed-Site, Personal and Carboxyhaemoglobin (COHb) Measures of CO Exposure. *Am J Resp Crit Care Med* 161(3):A176.

Petrovic, S., Urch, B., Kubay, J., Lukic, Z., Downar, E., Tofler, G., Tarlo, S., Purdham, J., Brook, J., Broder, I., Zimmerman, B., Corey, P., Liu, L., Dales, R. and Silverman, F. 1999. Cardiorespiratory Responses In Healthy Volunteers Exposed To Concentrated Particles From Toronto Air. *Am J Resp Crit Care Med* 159(3):A317.

Sang, S., Petrovic, S. and Cuddeford, V. Lindane – A Review of Toxicity and Environmental Fate. World Wildlife Fund Canada. November, 1999. <http://www.neteffect.ca/pesticides>

Hers, I., Zapf-Gilje, R., Petrovic, S., Macfarlane, M. and McLenehan, R. 1997. Prediction of Risk-Based Screening Levels for Infiltration of Volatile Subsurface Contaminants in Buildings. In: Dwyer, F.J., Doane, T.R. and Hinman, M.L. (eds.) *Environmental Toxicology and Risk Assessment. Modeling and Risk Assessment. Sixth Volume.* ASTM STP 1317. pp 265-285.

Rankin, M., Davidson, S., Drysdale, K., Miller, T., Petrovic, S., Zapf-Gilje, R., and Van Zyl, D. 1997. Submarine Tailings Discharges: Optimizing the Evaluation Process Monitoring. Presented at Tailing and Mine Waste '97. January 13-16, Colorado State University.

Miller, T.A., Petrovic, S.A., Stuckert, B.J. and McAndless, J.M. 1996. Ecological Risk Assessment of Sites Contaminated with Chemical Warfare Agents at Defence Research Establishment Suffield, Alberta. Presented at the 1996 Society for Risk Analysis Conference, December 8 to 12, 1996, New Orleans, Louisiana.

Rankin, M., Zapf-Gilje, R., Hers, I., Z'Graggen, M., Miller, T., Petrovic, S., and Fugler, D. 1996. Variability in Human Health Risk Assessment: Results of a Round Robin Assessment of Residential Exposure Scenarios. Presented at the 1996 Society for Risk Analysis Conference, December 8 to 12, 1996, New Orleans, Louisiana.

Rankin, M., Hers, I., Petrovic, S., Kim, M., and Zapf-Gilje, R. 1996. Human Health and Ecological Risk Assessment for Coquitlam Landfill Redevelopment. Presented at SWANA. 12th Annual Pacific Northwest Regional Symposium. Vancouver, B.C. April 24, 1996.

COURSES

- Risk Communication, Faculty of Extension, University of Alberta
- Lead Sampling Technician Training Course, Allstate Services Environmental Inc.

AWARDS/SCHOLARSHIPS

- Institute for Environmental Studies Graduate Fellowship, Arthur and Sonia Labatt Fellowship, 1998.
- University of Toronto Open Scholarship, Institute of Medical Science, 1998.